

What is claimed is:

1. A method of coating boron carbide on an aluminum-based member, comprising the steps of:

roughening a surface of a substrate comprising aluminum to a roughness of at least

2.5 μ m; and

forming a boron carbide layer upon said surface.

2. The method of Claim 1, wherein said forming step comprises thermal spraying to form said boron carbide layer upon said surface.

3. The method of Claim 1, wherein said forming step comprises chemical vapor deposition.

6. The method of Claim 1, wherein said forming step comprises surface conversion.

7. The method of Claim 1, wherein no more than a native oxide of aluminum intervenes between said substrate and said boron carbide layer.

8. The method of Claim 1, further comprising anodizing said substrate to form an anodization layer and wherein said forming step deposits said boron carbide layer upon said anodization layer.

9. The method of Claim 1, wherein a material of said substrate is selected from the group consisting of aluminum and aluminum alloys.

10. The method of Claim 1, wherein said boron carbide layer comprises B_4C .

Sub 11. The method of Claim 1, wherein said boron carbide layer comprises particles of B_4C .

11. The method of Claim 1, wherein said boron carbide layer comprises a composition between B_4C and $B_{13}C_3$.

5 12. The method of Claim 1, wherein said boron carbide layer comprises between 14 to 30 wt% of carbon relative to boron.

13. The structure of Claim 12, wherein said boron carbide layer comprises between 18 to 25 wt% of carbon relative to boron.

14. A method of forming a boron carbide layer on an aluminum-based substrate, comprising:
anodizing a surface of an aluminum-based member to form an anodization layer; and then depositing a boron carbide layer upon said anodization layer.

15. The method of Claim 14, wherein said depositing step comprises thermal spraying.

16. The method of Claim 14, wherein said depositing step comprises chemical vapor deposition.

17. The method of Claim 14, further comprising the step, performed prior to said anodizing step, of roughening at least a first portion of said surface of said aluminum-based member and wherein said anodizing step anodizes said first portion and said depositing step deposits said boron carbide layer on said anodization layer overlying said anodized first portion.

18. The method of Claim 17, further comprising removing said anodization layer from a second portion of said member adjacent to said first portion, said roughened first portion extending below a portion of said anodization left by said removing step.

19. The method of Claim 17, wherein a material of said member is selected from the group consisting of aluminum and aluminum alloys.

20. The method of Claim 17, wherein said boron carbide layer comprises B_4C .

21. The method of Claim 17, wherein said boron carbide layer comprises particles of B_4C .

22. The method of Claim 17, wherein said boron carbide layer comprises a composition between B_4C and $B_{13}C_3$.

23. The method of Claim 17, wherein said boron carbide layer comprises between 14 to 30 wt% of carbon relative to boron.

24. The structure of Claim 23, wherein said boron carbide layer comprises between 18 to 25 wt% of carbon relative to boron.

25. A composite structure, comprising:

an aluminum-based substrate;

an anodization layer formed on at least a first portion of said substrate; and

a layer of boron carbide coated on said anodization layer overlying said first portion.

26. The composite structure of Claim 25, wherein said first portion of said substrate is roughened to a roughness of at least $2.5\mu m$.

27. The structure of Claim 25, wherein said substrate has a composition selected from the group consisting of aluminum and aluminum alloys.

28. The structure of Claim 27, wherein said layer of boron carbide comprises between 14 to 30 wt% of carbon relative to boron.

Al₉
B₂
C₃